

Concept for Teaching *Theory of Composition and Form Formation*

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Abstract

In the article, the author shares her experience of teaching the disciplines *Form Formation* and *Theory of Composition* to students of Engineering Design in the Forestry University in Sofia. The goals of the two disciplines are set out, namely: the aim of the discipline of Form Formation is to teach students the objective laws of the organization of the form and form formation in the world, knowledge attained thus far by the natural sciences. The aim of the discipline Theory of Composition is to teach students the laws of human perception, knowledge attained by the humanities.

The focus is on a number of modern sciences, such as - in Form Formation - sciences of the organization of the matter in systems, structures, constructs and shapes; sciences of symmetry and rhythm; Synergetics; fractal geometry; bionics, etc. In Theory of Composition, these are respectively, psychology of perception, Gestalt psychology, semiotics, poetics, theory of manipulation, etc.

Examples are given of the application of new teaching methods, including interactive forms of education and the organization of extracurricular events such as competitions, public readings, debating sessions, etc.

The conclusions stress the importance of keeping the two disciplines up-to-date with the developments in modern science, and respectively, with the new requirements regarding design.

Keywords

Composition Theory; Form Formation; Teaching Methods

Introduction

In this article we share our experience of teaching the disciplines *Form Formation* and *Theory of Composition* to students of Engineering Design in the Forestry University in Sofia.

We start off by presenting the objectives of the two disciplines in the teaching of specific knowledge (For the differences between the two disciplines see Zheleva-Martins, D., "Theory of Form Formation/Theory of Composition: In Search of

Differentia Specifica" – In: "Educating Designers for a Global Context?" – Proceedings of the 4th engineering & Product Design Education, International Conference, Salzburg, University of Applied Sciences, September 2006, Austria, Published by Hadleys Ltd., United Kingdom, pp.323-328.) in each of them.

Form Formation

The aim of the discipline of *Form Formation* is to teach students the objective laws of the organization of the form and form formation in the world. Using the screening method with regard to form formation, students acquire knowledge which has been attained until now by the natural sciences and which would come in handy in their future work as designers.

Students analyse self-formation and the creation of shapes in nature, for example:

- the emergence of forms of different phenomena in the inanimate nature under the influence of different form-formation factors, such as galaxies and the solar system; the atom; raindrops, hurricanes, tornadoes, sand waves, stalagmites and stalactites; dunes, etc., etc.;

- the creation of forms by living organisms; construction by animals, such as nest building by birds, building of dens by monkeys, ant-hills, underground mazes; spider cobwebs, etc.;

The essence of objectively existing forms and spaces as physical phenomena is studied and analysed. Students learn about the principal laws of the objective form formation independent of humans on the one hand, and on the other, of the conscious and purposeful form creation by humans, via the systematization, structuring, construction of forms by following basic mechanisms based on the physical and mathematical laws, as well as by using symmetry and rhythm as fundamental categories in the quantification of space and time, respectively.

Since symmetry is directly related to gravitation and the forces of attraction and repulsion in the physical world, it is explored in all of its variations, such as: symmetry of discrete figures and symmetry of infinity; symmetry in the plane; symmetry in space; bilateral symmetry; radial symmetry; curvilinear symmetry; colour symmetry; symmetry of similarity, etc.

Rhythm is another category in form formation similar to symmetry but one concerning time. The types of rhythm are defined as rhythm of discreteness; rhythm of continuity; regular and irregular rhythm; flow rhythm and field rhythm, etc.

Rhythm and symmetry are commensurate. This commensurability is the thing that allows for the geometric and algebraic description of shapes and their modelling.

A separate subject matter taught in the lectures on form formation is the study of the genesis of form creation by animals and humans, starting from the instincts for building and the awareness about them, as well as the laws and mechanisms for the generation of shapes, the laws and means for construction of shapes under the influence of fundamental form-formation factors.

Special attention is paid to Synergetics as a science studying self-organization in the world and the so-called dissipative structures. The most common types of structures are studied, such as centric, spiral, skeletal, etc.

Separate study is offered of the types of constructs through which these structures are materialized, e.g., skeletal, monolithic, shell, pneumatic, tent-like, arch, cellular, corrugated, etc.

Modelling is explored as a separate subject, giving an idea of the types of modelling, including mathematical modelling.

Knowledge of the form-formation factors is offered as well, provisionally classified as functional, constructive, technological, social, natural, etc.

The specifics of form formation are explored from the point of view of industrial design and combinatorics. A review is made of the methods for the rational construction of shapes, taking into account the combined influence of a number of forces; insight is offered on notions such as permutation, combination, re-combination, transformation, etc.

New sciences and technologies having a bearing on

form formation in design are examined, such as bionics, which is a topic of a special assignment in the seminars on form formation; theory of chaos and fractal geometry, nano-technologies and form formation, etc.

The study of form formation has as its objective to teach rational knowledge about the logic of shapes in the objective world, taking into account the forces and conditions of the material physical environment.

A notable peculiarity in this respect is that human feelings and perception are ignored and the attainment of shape is abstracted from the requirements of aesthetics, composition or the artistic effect of the result. The beauty of the attained form is considered as a consequence, and not as a goal, no matter how absurd this may sound to the artistic ear of the designer.

Theory of Composition

The aim of the discipline *Theory of Composition* is to teach students the laws of human perception, knowledge which has already been attained by the humanities.

Students learn about the historical development of the notion of composition, the accumulated knowledge and experience in the arts for bringing forth certain impressions about ideas, topics, plots, sensations, emotions, etc., via laws, principles, means, rules, methods and techniques for manipulation of perception derived from practice and formalized by the science of artistic composition.

The students are taught key concepts, laws and means of composition, which form the basis of any elementary course in composition theory. The distinct difference is in the purposeful directing the attention of the students towards the human and emotional aspect that lies at the core of this science.

Composition is viewed as a means for achieving, via art and design, of psychological and emotional adaptation of the human being to the world, in the name of his/her homoeostasis.

This is why the lectures lay the stress on a number of modern sciences such as psychology of perception, semiotics, the science of signs and sign systems, poetics, theory of manipulation, etc.

The attainment of the spiritual form of objects is studied, a form which is justified by its use, which is appropriate, which has a definite functional,

constructive and aesthetic value, but which is nevertheless tailored to the psycho-physiology of the person that will use, contemplate, feel and enjoy it...

One of the main precepts that underpin the teaching of the discipline is the psychology of human perception. Special attention is paid to Gestalt psychology and the principles thereof, projected on to the subject matter of design. Putting the image at the centre of attention, Gestalt psychology - as soon as it appeared - had a strong and lasting impact on the rationalization of a number of theoretical precepts in all arts, design including.

Gestalt psychology operates with basic laws and principles, some of which are studied in greater detail in the course, given their direct relation to composition. These are for example the law of proximity, the law of relationship (figure/ground). It would be superfluous to explain the importance in composition of connecting the elements in one dynamic whole, given the meaning-generation or emotional role they have to play. The perception of the Gestalt depends on the treatment of the separate parts - a figure or background, which constitute it. The law of proximity is equally important in composition where creating harmony or hierarchy in the parts is performed with nothing else but the primary act of grouping.

From among the basic principles of the organization of perception we have selected those that have a bearing on composition, i.e., the principle of proximity, of similarity, of continuity, of totality, of closure or of transposition, of Good Gestalt or of *Prägnanz*, the principle of good form, of simplicity, ease and regularity; the principle of repetition, of copying, of imitation; the principle of differentiation; of isomorphism; of common fate, among others.

The lectures are illustrated with popular examples of the organization of perception, such as examples of different illusions: the Muller-Lyer illusion, the Ponzo illusion, the Wundt illusion, the Fraser illusion, the Jastrow illusion; examples of the so-called "dual images"; "impossible objects", etc.

Also explored are certain effects of perception studied by Gestalt psychologists, such as the so-called Phi phenomenon, or the effect of apparent movement; simultaneous contrast phenomena; the insight phenomenon, etc.

Since theory of composition develops in line with cognitive sciences and actively uses their results, the second focus in the training course is on the science of

sign system, semiotics. Semiotics is a science of human communication by means of signs.

It is exactly via artistic composition that the design becomes a language, a means of visual, tactile, or other communication. Studying artistic composition in a semiotic aspect, as a sign system, provides an opportunity of including the modern methodology and tools of semiotics in the design process.

The students are taught to communicate via the design product. To achieve this, they learn about the mechanisms of semantization, of filling the image they create with meaning and significance. The information conveyed through the image is coded. Thus, before anything else, students acquire the skill of decoding, i.e., the skill of reading the designer texts; next, they learn how to code information themselves by means of different signs: icons, indexes and symbols, incorporated in their design products.

Without trying to exhaust all topics covered by the lecture course, we will only mention that special focus is also laid on poetics, the theory of manipulation, on the introduction of multi-modality in the composition, among others.

Methods of Teaching

We shall now dwell more concretely on the methods of teaching we use, the introduction of interactive forms of training, and the organization of extra-curricular events in the two disciplines.

As soon as the first classes, students are given home assignments: essays on given topics, which they have to write themselves. All essays are marked, and, together with test results and seminar work, make up the student's course grade. In the course of the semester each student prepares between 6 to 8 essays in each of the two disciplines.

Below are some examples of essay topics on Form Formation: "What do I understand under form"; "Describe the form and the form-formation factors of a natural phenomenon of your choice" (e.g., tornado; sand dunes; waterfall; volcano, etc.); "Analyse the construction and shape of the home of an animal of your choice".

The topic of *Symmetry* is considered in the following essays: "Describe the symmetry phases of a falling drop of water"; "Trace the interpretation of the drop of water in design"; "Provide examples of application of regular polyhedra in design"; "Analyse the symmetry

of the mosaics from the Alhambra, Spain. Generate your own mosaics on the basis of the same module".

The topics covered in the lectures on *Modelling* are developed in several successive essays: "Analyse a leaf from a deciduous tree"; "Analyse geometrically a leaf of your choice"; "Extract a structural model of a leaf"; "Using the same model, generate a product of your own design".

Simultaneously with these, other assignments are given for independent or collective work during seminars on Form Formation. The assignments are temporally and thematically related to the course of lectures, for example:

Symmetry: Regular and semi-regular polyhedra. Graphic description through the three elements of symmetry. Transformation of regular polyhedra in flat-sheet, ribbed, and other structures. Symmetry groups in the plane. Analysis of flat mosaic structures. Symmetry of solids. Analysis of the influence of gravitation on the symmetry of solids.

Fractals: Study of the qualities of fractals. Types of fractals. Form formation of snowflakes. Generation of snowflakes with fractal methods. Generation of fractal structures.

Phyllotaxis: Analysis of the structure of the leaf. Extraction of a geometric model. Interpretation of the model. Analysis of examples in the area of design.

Bionics: The students are divided into groups for teamwork; individual assignments are handed out as well. Explanations of the aims and objectives of the assignment in bionics. Selection of a biological system for analysis. Discussion within the team. Analysis of the shape, structure, material, function of the chosen object (part of an object). Presentation of the results of the analysis. Evaluation of the results of the analysis. Extraction of a functional, structural, geometric, and mechanical model. Building a small-scale model from the extraction. Interpreting the model into a product. Preparation of working designs. (The seminars are taught by Senior Research Assistant Dr Miroslava Petrova (Dipl. Eng.).)

The essays in Theory of Composition are on the following topics:

Notion of composition: "Describe the interior personally experienced by you. Explain what impressed you in terms of design"; "How would you define the term *composition* and what do you think the science of composition is about".

Proportion: "Analyse the golden section and draw a golden spiral".

Semiotics: "Describe the semantics of the throne"; "What meanings you need to code in the design of the interior of a parents' bedroom"; "Describe the conventional and emotional meanings of the colours in the colour spectrum, according to the European tradition", etc.

The tests are on similar topics, for example: "Requirements towards the baby cradle. What meanings and emotions will you code in a baby cradle designed by you, and how. Describe and sketch".

We have organized a number of extracurricular events in both disciplines, for example, thematic competitions. Here is an announcement about such a competition:

"Use your imagination and what you have learned so far about form formation, symmetry, rhythm, the laws of organization of systems, structures and constructs in the world, the creation, analysis and interpretation of models..."

Make, using materials of your choice:

New Year's indoor decorations

Christmas tree decorations

Presents: origami, combinatorial and other games for children

Wrapping for Christmas presents

The entries will be judged by a jury of teachers and the best ones will get awards".

Another extracurricular event is public presentations of papers. Students wishing to improve their semester grades prepare a paper on a topic chosen from a set list.

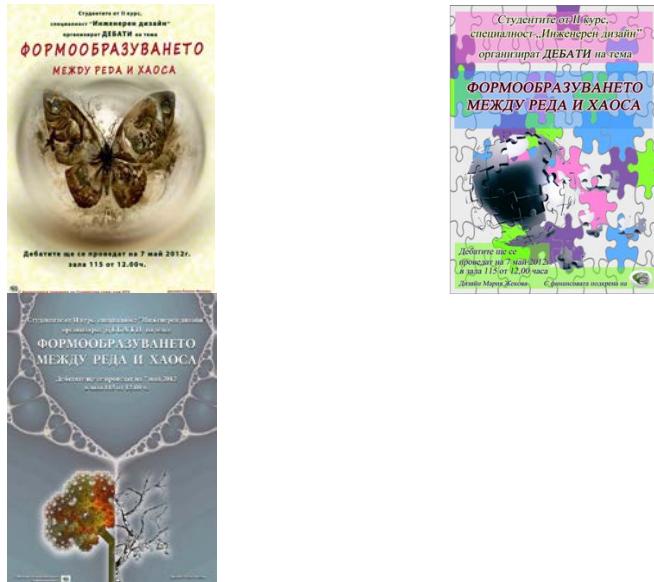
As part of the course on *Theory of Composition* a student research conference on "*The Principles of Gestalt Psychology and Their Application in Design*" was held in 2011. The conference enjoyed the exceptionally keen interest of not just the students enrolled in the course, but fellow students from other disciplines and teachers. A competition for a poster of the conference was held prior to it and the best posters entered in the competition were printed and displayed at key points in the university building. One third of the students enrolled in the course took part in the conference with presentations and posters on topics they had explored with great zest. The proceedings of the conference are being issued on a compact disc. The participants in the conference received certificates from the dean's office. Furthermore, thanks to the participation in the conference and high grades, many of the students won

prizes at competitions, placements in workshops abroad, EU grants.

As part of the course on *Form Formation* in 2012 we organized students debating sessions on "Form Formation between Order and Chaos".



POSTERS OF THE CONFERENCE "THE PRINCIPLES OF GESTALT PSYCHOLOGY AND THEIR APPLICATION IN DESIGN"



POSTERS OF THE DEBATES "FORM FORMATION BETWEEN ORDER AND CHAOS"

The very form formation in contemporary scientific theories is explored through the basic opposition and movement between chaos and order, between the tendency towards entropy and the tendency towards organization and structure. Human activity, including design, seeks to establish order, organization and to reduce entropy. This was the topic of the debates. The theme was discussed along the following lines: Order – Systems; Structures; Symmetry; Rhythm. Chaos – Theory of chaos, key concepts; Brownian motion; Bifurcation; Catastrophe theory; Synergetics; Organized chaos; Rayleigh – Bérnard convection; Turbulence; Self-excited wave processes.

The aim of the debates was not so much to pick out a winner but to gain a deeper understanding into the nature of the form formation principles in the world

and perceive them as a dynamic dialectic opposition in the light of the most recent scientific theories.

Another no less important aim of the debates was to stimulate students to take an active part in the acquisition of knowledge. It is a widely accepted fact that one learns less with listening, perception, and observation than when the three are complemented by independent exploration of problems, preparation for presenting ideas and arguments, formulating questions, peer discussions, arriving at the most adequate solutions, teaching one's knowledge to others, including teachers.

The interest to the debates was again very keen. They had many and active participants. The students were divided into teams, "Order" and "Chaos", and argued their theses, presented in Power Point slides. There were Q&A sessions, including questions from the audience and teachers.

Debates stimulate creativity, the students' research capabilities, the skills to formulate and express views and opinions, to set forth theses, and defend one's stand in an intelligent and respectful manner, observing the ethical rules of dialogue. Debates teach critical thinking, communicative culture, the art of arguing and the art of rhetoric, and also discipline thinking and behaviour.

Conclusion

All this constitutes a substantial preparation for the professional career of the designer who needs to have excellent persuasive skills in order to win over colleagues, consumers, investors and the like.

Also important is fostering in the students a spirit for competitiveness because the driving force for artistic creativity is no other but competitiveness.

In conclusion, we would like to say that the introduction of these interactive forms of teaching is definitely very much liked by students who get emotionally and passionately involved in their future designer's job. We, the teachers, are happy to witness their achievements – the students win international awards (LEGO finalist portrait: Maya Ivanova & Svetlana Pencheva (Creativity Box) - <http://www.scapackaging-design-challenge.com/news/lego-finalist-portrait-maya-ivanova-svetlana-pencheva-creativity-box/>). End of the competition for designing BOSCH's Green Kitchen - <http://www.thehome.eu/news/item/127-the-winners-in-design-bosch-green-kitchen-contest-arranged-by->

[bosch-siemens-domestic-appliances](#)), become good designers and find their place in the professional field in their home country and abroad.

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